Using Pregnancy Rate to Monitor Reproductive Management

DON NILES, DVM—Monsanto Dairy Business, 2027 South Cottonwood, Visialia, CA 93277
Tel: 209-636-3842 don.e.niles@monsanto.com

STEVE EICKER, DVM, MS—Valley Ag Software Paul Rapnicki, DVM, University of Minnesota

STEVEN STEWART, DVM—University of Minnesota

Introduction

Excellent reproductive performance is essential for the success of any dairy operation. Excellent reproductive performance can be summarized as the ability to consistently have the higher producing animals in a herd conceive and maintain pregnancies in a timely, economically justified manner.

Maintaining a consistently high-performing reproductive program requires a substantial investment in management, labor, and other costs such as semen and drugs. Given the importance, costs, and the dynamic nature of these programs, careful monitoring of the current performance is essential. This paper will discuss the use of the measure called "pregnancy rate" to monitor current reproductive performance.

Pregnancy Rate

Many different measurements have been employed to assess reproductive performance. Some commonly used measurements include average days open, first service conception rate, annual services per conception and calving interval. Unfortunately, these measures can fail to detect drops in performance on a timely basis. Ultimately, the question of interest to dairymen is "How many of the cows eligible to become pregnant actually became pregnant in a given time frame?" Since the value is in the pregnancy, a measurement is needed to detect the rate that pregnancies are occurring in eligible cows.

Recently, there has been much talk in the popular press about using pregnancy rate (PR) to assess reproductive performance. Pregnancy rate can be defined as the percentage of cows eligible to become pregnant, in a given time frame, that actually do become pregnant. A logical time frame would be 21 days, the typical length of an estrus cycle.

The pregnancy rate calculation allows an assessment to not only determine how well cows are conceiving but also how quickly they are conceiving. Furthermore, by subdividing the breeding program into twenty-one day intervals, it can determine the effect of any recent changes on the breeding program.

The concept of PR can best be illustrated with some simple examples. Consider a single cow that is turned in with a bull. In the first example shown below, the cow conceives in the first 21-day period with the bull. The pregnancy rate at the end of the 21 days is 100%. In other words, all eligible cows (i.e., the one cow) settled in the first 21-day opportunity. Note that the pregnancy rate is still 100% even if the dairy did not detect the pregnancy until three months later. Because she settled immediately, she was still only "at risk" for getting pregnant for one (the first) cycle, even though she was present all three 21-day periods.

Example #1

Cow ID	First 21 day interval
1	Became Pregnant

Cow ID	First 21 day interval	Second 21 day interval	Third 21 day interval
1	Became Pregnant	Not Eligible	Not Eligible

What if the cow did not become pregnant until the 45th day after exposure to the bull? In this case, the pregnancy rate would be 33% because one cow became pregnant in three cycles at risk.

Example #2

Cow ID	First 21 day interval	Second 21 day interval	Third 21 day interval
1	Open	Open	Became Pregnant

The situation can become a bit more complicated with two cows. Suppose two cows were introduced to the bull at the same time. If one cow settled in the first 21 days and the other settled in the third 21-day period, what would the

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pregnancy rate be? It would be 50% because two pregnancies occurred in four "at risk" cycles.

Example #3

Cow ID	First 21 day interval	Second 21 day interval	Third 21 day interval
1	Open	Open	Became Pregnant
2	Became Pregnant	Not Eligible	Not Eligible

This calculation measure can also be used even if all cows are not yet pregnant. Again, in the example, two cows are put with the bull. One cow settles on the first day, while the other is still not pregnant after nine cycles (189 days). In this case, the PR is 10%. One cow became pregnant in 10 total "at risk" periods (1+9).

Example #4

Cow ID	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Cow 1	Preg	Not Elig	Not Elig	Not Elig	Not Elig	Not Elig	Not Elig	Not Elig	Not Elig
Cow 2	Open	Open	Open	Open	Open	Open	Open	Open	Open

Pregnancy rate has often been defined as heat detection rate (HR) multiplied by conception rate (CR). In many instances this will give a reasonable approximation of the actual PR. However, this "shortcut" can at times lead to very misleading results, especially if typical DHIA summary numbers are used. The reasons for this error include the exclusion of culled animals, the exclusion of animals once they enter a bullpen, use of different time frames and different animals in the two parameters, and the possibility of the same animal appearing more than once in a single 21day time interval.

Using this method also leads to the impression that it is necessary to know heat detection rate and conception rate in order to calculate the pregnancy rate. However, note that in the above examples we did not have to know how many times the animals were detected in heat nor the success of any of the individual breedings to calculate an overall pregnancy rate. The examples also illustrate that pregnancy rate calculations can be used whether the reproductive program is 100% artificial insemination, 100% natural service, or some combination of both. Therefore, pregnancy rate provides a method to monitor the rate at which cows become pregnant. However, there are some considerations before use. One consideration is whether the 21 day interval being considered is a:

- 21 day "calendar" window (e.g., January 1st to 21st)
- 21 day increment of days in milk (e.g., 50 to 70 days in milk)
- 21 day increment of days since entering a bull pen

The pregnancy rate concept lends itself well to analysis on a dairy. Table 1 represents a 2,000 cow dairy in central California. The chart calculates the pregnancy rate for each 21-day calendar period for the last year. The column labeled "Pg Elig" shows all the cows eligible to become pregnant in the 21-day period on the same line. In this example, a cow had to be more than 50 DIM (VWP) and open at the beginning of the 21 days to be considered eligible. The column headed "Preg" is the actual number of those eligible cows that did become pregnant during the 21 day period. Finally, the "Pct" column is the pregnancy rate, the percentage of the eligible cows that actually became pregnant during the given time frame.

In this herd, pregnancy rates ranged from 8% between 7/17/00 and 8/7/00 to 20% in the period between 4/24/00 and 5/15/00. By examining the pregnancy rate every 21 days, a dairyman can better understand not only how reproduction is doing now, but also what changes have occurred over time. In the herd used in this example, there is a noticeable downturn in pregnancy rates in both the summer of 1999 and 2000.

In cases where bull pens are properly identified and the movement of cows are properly recorded, further analysis is also possible. Table 2 represents the same herd as Table 1, but only the pens containing bulls are included.

In this case, to be eligible, a cow has to be more than 50 days in milk, not pregnant at the beginning of the 21-day period, and in a bull pen for at least 21 days (1 cycle). This chart, then gives a measure of the success of achieving pregnancies in the bull pens. The performance can be seen to vary considerably, dropping as low as single digits in summers and reaching as high as 38%. This information is valuable to a dairy, as assessments can be made of the overall efficiency of the bull program and as an ongoing monitor of the bull pen management and performance.

Also, if the bull pens are properly identified, accurate assessments can also be made of performance in pens without a bull, i.e. the artificial insemination program

Table 1			
Date	Pg Elig	Preg	Pct
9/6/99	332	36	10
9/27/99	386	49	12
10/18/99	419	67	15
11/8/99	467	96	20
11/29/99	468	71	15
12/20/99	481	92	19
1/10/00	473	90	19
1/31/00	481	83	17
2/21/00	484	66	13
3/13/00	457	66	14
4/3/00	439	72	16
4/24/00	450	91	20
5/15/00	428	72	16
6/5/00	400	40	10
6/26/00	380	41	10
7/17/00	372	30	8
8/7/00	0	0	0
8/28/00	0	0	0
Total	6917	1062	15

Table 2			
Date	Pg Elig	Preg	Pct
9/6/99	166	15	9
9/27/99	154	18	11
10/18/99	144	30	20
11/8/99	137	29	21
11/29/99	123	26	21
12/20/99	140	30	21
1/10/00	132	41	31
1/31/00	156	28	17
2/21/00	143	16	11
3/13/00	119	18	15
4/3/00	77	30	38
4/24/00	150	44	29
5/15/00	229	31	13
6/5/00	191	25	13
6/26/00	240	25	10
7/17/00	205	14	6
Total	2506	420	16

cows. An example pregnancy rate calculation for these cows can be seen in Table 3. This is the same herd as the other examples, except these are now the cows in the AI pens. In this example, to be pregnancy eligible, a cow needs to be 50 days in milk, not pregnant at the beginning of the 21 days, and have remained in the AI pens for the full 21 days. This chart, then, shows the efficiency of the AI breeding and would allow management to evaluate the success of the AI program

In the case of the AI program, the evaluator can go another step in the breeding analysis. Because all breedings are recorded in a typical AI pen, the heat detection rate (HR) can also be measured. The heat detection rate, similar to the PR, shows the percentage of eligible cows actually detected in heat within a given 21 day time frame. This gives management one more powerful tool in evaluating reproductive performance.

The final example, Table 4, is yet another look at the same herd. This chart illustrates how eligible cows can be grouped by a measure other than calendar dates. In this case, the HR and PR are calculated for different groups of cows based on their days in milk at the time of eligibility. The chart shows that 1,341 cows were pregnancy eligible for the 21 day period beginning with their 50th day in milk. Of those cows, 248, or 18% actually became pregnant in the next 21 days in milk. However, since this table includes all cows that have freshened in the past 365 days, this measure has a great deal of momentum and may delay early diagnosis of a change in reproductive performance.

Industry Benchmarks

There are several sources of data available to show typical pregnancy rates in the dairy industry. Graph 1 shows the overall (AI and natural service) pregnancy rate distribution of 80 California herds, representing 100,000 cows. Graph 2 shows the similar data from a Minnesota study. Data was from over 2,200 herds and 250,000 animals. Although the average in both groups is 14 to 16%, many good dairies can consistently maintain pregnancy rates at 20% or more. Once dairy management has the ability to accurately and easily assess pregnancy rates, appropriate interventions can be made to improve reproductive performance long before traditional reproductive parameters would have shown a problem existed.

Further observations can be made by dividing the herd into subgroups. For instance, it is often assumed that bulls will get cows pregnant at a faster rate than artificial insemination. In our experience on commercial dairies, this is not always the case. In most instances the

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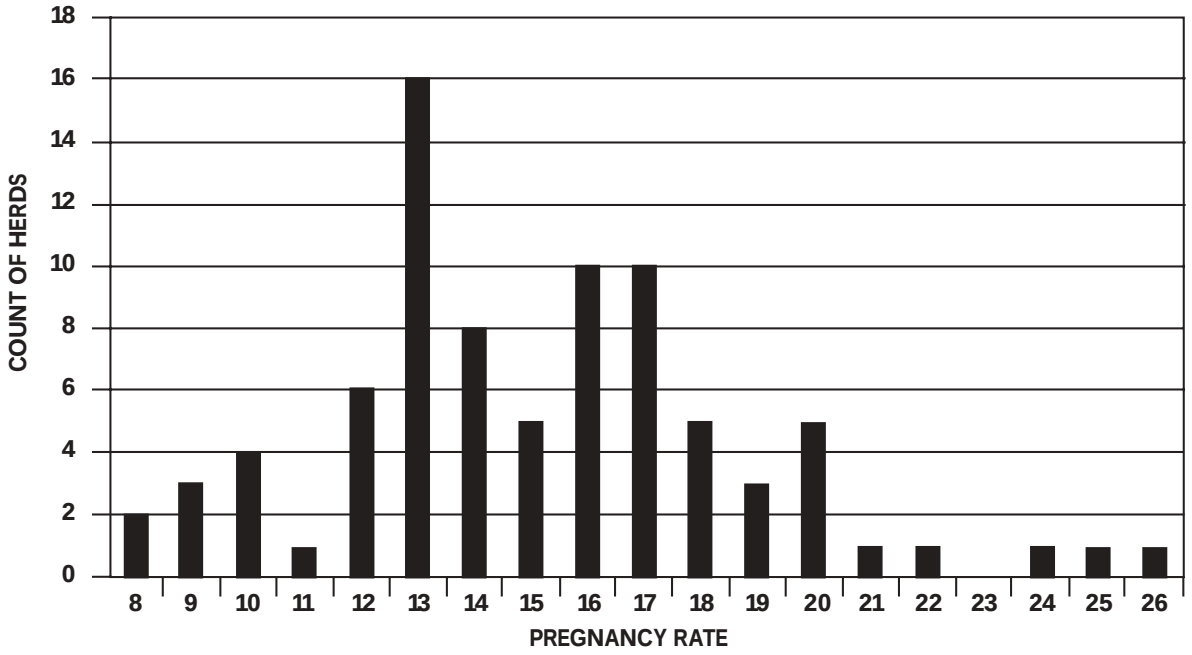
Table 3

Date	Ht Elig	Heat	Pct	Pg Elig	Preg	Pct
9/6/99	175	95	54	175	21	12
9/27/99	226	140	61	226	31	13
10/18/99	262	157	59	262	36	13
11/8/99	326	182	55	325	72	22
11/29/99	311	178	57	311	49	15
12/20/99	318	177	55	317	64	20
1/10/00	305	184	60	303	55	18
1/31/00	331	180	54	330	57	17
2/21/00	349	186	53	346	50	14
3/13/00	353	210	59	346	49	14
4/3/00	293	171	58	289	48	16
4/24/00	226	164	72	223	53	23
5/15/00	206	116	56	205	41	20
6/5/00	212	98	46	210	19	9
6/26/00	144	69	47	142	17	11
7/17/00	154	82	53	153	18	11
8/7/00	146	75	51	0	0	0
8/28/00	116	80	68	0	0	0
Total	4191	2389	57	4163	680	16

Table 4

DIM	Ht Elig	Heat	Pct	Pg Elig	Preg	Pct
50	1341	727	54	1335	248	18
71	1112	622	55	1108	195	17
92	896	462	51	893	138	15
113	689	369	53	683	101	14
134	390	218	55	385	52	13
155	169	108	63	167	28	16
176	70	38	54	68	9	13
197	20	12	60	19	3	15
218	16	4	25	16	1	6

Graph 1. California Data Set



Graph 2. Minnesota Data Set